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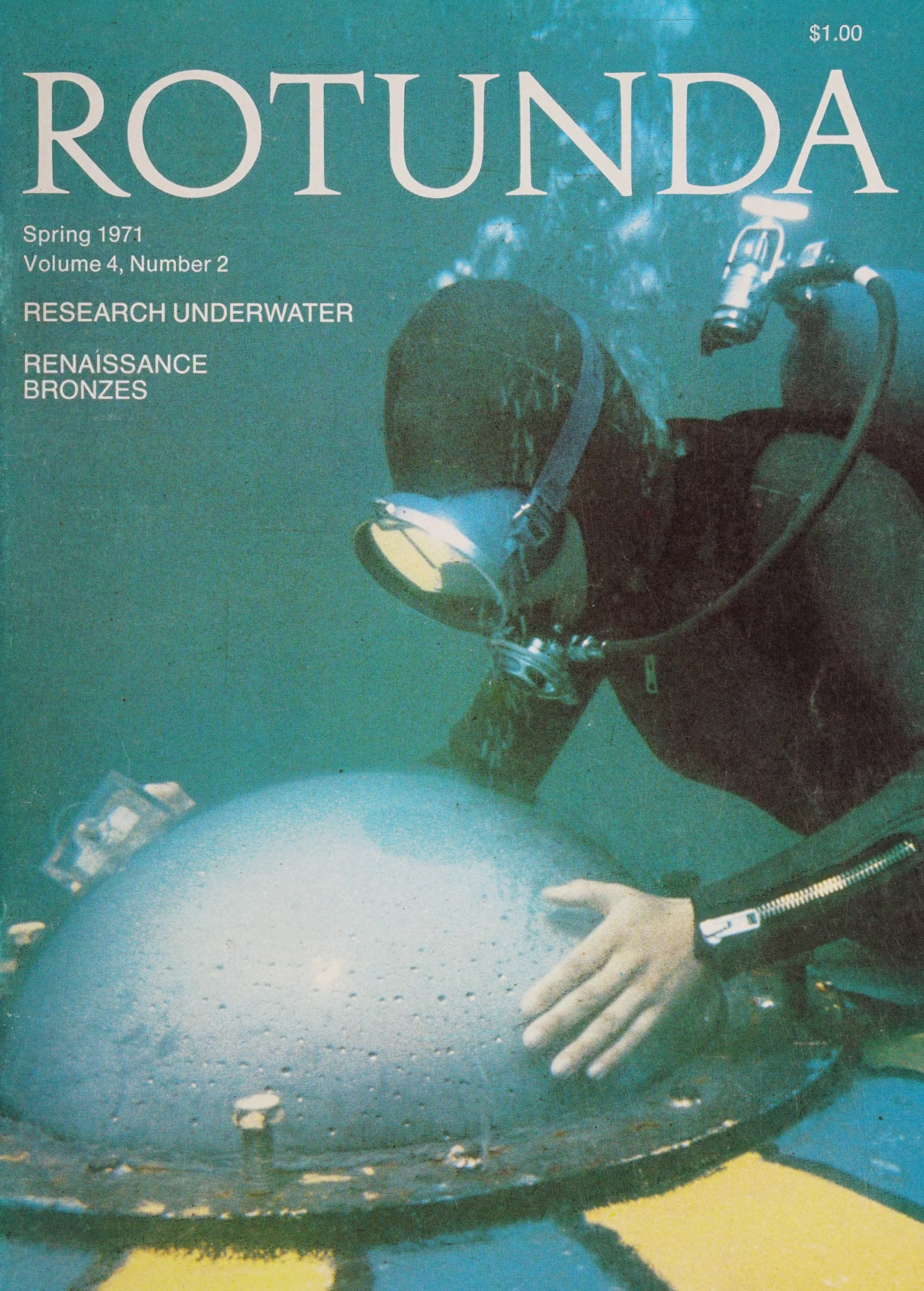
ROTUNDA

Spring 1971
Volume 4, Number 2

RESEARCH UNDERWATER

RENAISSANCE BRONZES



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ROTUNDA

the bulletin of The Royal Ontario Museum

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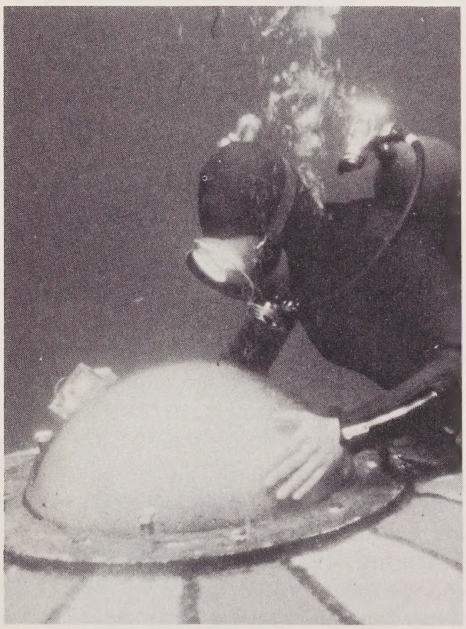


Vol. 4, No. 2 Spring 1971

Maya monkey skull carved in limestone

Spotlight with the Editor

Past, present and future at the ROM

COLD, COLD, SUBLIMNOS

The potential of riches beneath the world's waters already is clearly considerable. Oil, minerals and food are there in abundance. As you will gather from the story on page 21 the Royal Ontario Museum is not neglecting this area of exploration. It describes experiments with Sublimnos in the cool waters off Tobermory. Since then Sublimnos has plunged to even chillier depths.

During February the underwater habitat spent a week on the Arctic seabed. Outside, the water temperature was a constant 28.5 degrees. Above was five feet of sea ice and beyond that the air temperature ranged from 40 to 50 below zero.

The expedition, organized by the MacInnis Foundation and supported, in part, by ROM, was primarily designed to evaluate underwater equipment. In addition biological observations were made, photographs taken, and marine specimens collected.

HUNGARIAN POSTSCRIPT

Last Fall's Hungarian Gala Evening was spectacular, lavish and memorable. The memory will be long lasting.

Already, as a result of the evening, Toronto's Hungarian community has presented two antique Hungarian dresses to the Museum's Textiles Department. Now, Mrs. Dora de Pedery Hunt has presented the evening's proceeds, a $2,000 cheque, to ROM's Purchase Trust Fund.

GROUP OF 100

Remember March 1967? That's when Director, Peter Swann, founded the Group of 100 and the group has come a long way since then.

The idea was to get together 100 corporations and individuals who would each donate up to $1,000 annually to ROM's Purchase Trust Fund. The fund has benefited handsomely and now stands at $402,000, earning interest that totals $78,300 over the past four years. Only the interest may be spent. So far $56,500 has been used to purchase ten important objects.

These range from the most costly item, a bronze statuette of the Italian Renaissance purchased for $16,500, to the least expensive, an 18th century Japanese Noh robe which cost $390. Other items added to ROM's collections: a collection of 19th century jewellery, a 12th century wood sculpture from Japan, and a Maya carved limestone monkey skull, macabre maybe but fascinating.

There's still room for new members in the Group of 100. At the moment membership consists of 49 individuals and 31 corporations.

DIGS IN 1971

A. D. Tushingham, ROM's Chief Archaeologist has mapped out an ambitious programme of excavation for this year.

In Iran, Cuyler Young Jr. will direct the third season of digging at Godin Tepe, while nearby, Lou Levine will be opening a smaller site at Seh Gabi in search for earlier finds, perhaps reaching back to the 4th millennium B.C. Not too far away, relatively, in Turkey, Michael Gough will direct the Museum's second season of work on the 5th century Byzantine monastery at Alahan. Chiefly he will be studying artifacts already found. Later, moving on to Crete, he will complete work on a Roman villa at Cnossus.

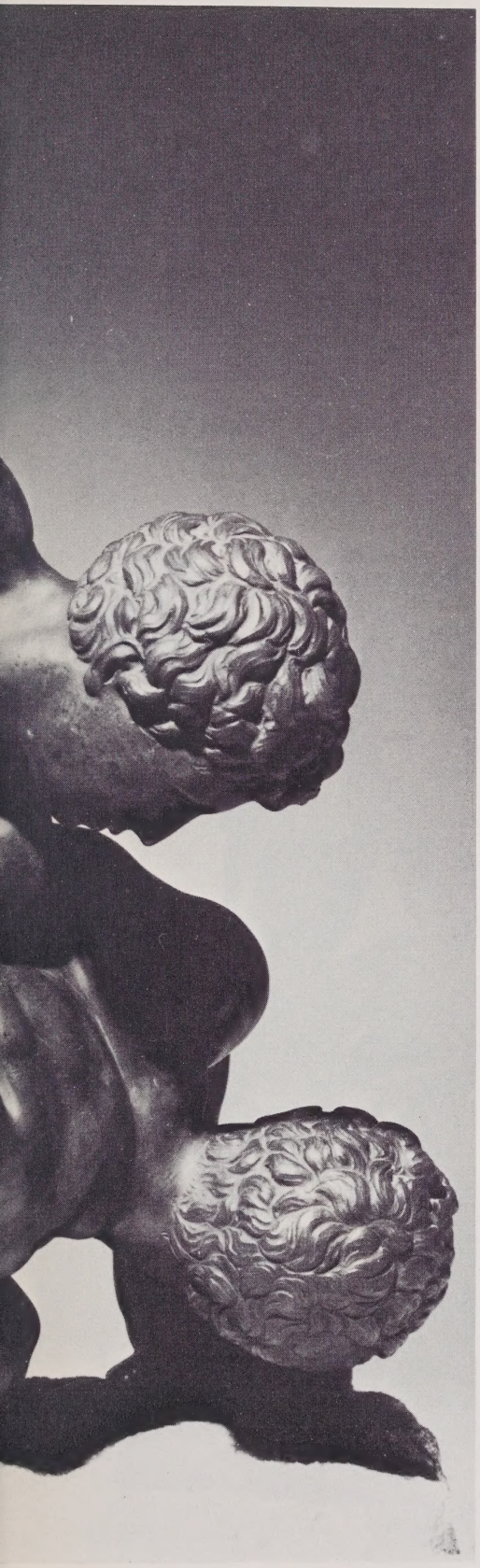
Francis Pryor is, at this moment, digging at a Bronze-Iron Age site near Peterborough, England. The crew and the financing is mostly British but after May it becomes totally an ROM project and one likely to continue for at least five years.

In Central America, David Pendergast is now consolidating seven years of ROM work at Altun Ha, Belize, in preparation for publication. He's also doing some field work for the local government. Further south, in Peru, prospects are good that digging will start in July on a new site at Pampa Grande in the Lambayeque Valley. It will be a multi-faceted project involving architects and ecologists as well as archaeologists. Kent Day will direct operations that are expected to reveal 1500 years of history up to the Spanish Conquest. The dig is notable in that it will be the first that ROM has operated on a 12-month basis.

Others will be closer to home. Walter Kenyon and Peter Storck will be working on various prehistoric sites in Canada, Donald Webster on historic sites, while Selwyn Dewdney will continue his recording of Ontario pictographs.

And Dr. Tushingham? He'll be staying at home. "I have two years solid work of research and writing right here in my office."

Bronze statuette of an Old Testament prophet, attributed to Antonio Bernardini Calcagni (1536-1593)



SMALL BRONZES OF THE RENAISSANCE

by K. Corey Keeble

Curatorial Assistant,
European Department

In ancient Rome, a small bronze statuette of Hercules received a rave review that would delight any artist in any age.

". . . . such dignity had the work, such majesty, despite its narrow limits. A god was he! . . . small to the eye, yet a giant to the mind . . . what daring imagination the cunning master had, at once to model an ornament for the table and to conceive in his mind mighty colossal forms."

This description by Statius was also representative of the great regard the classical world had for small bronze statuettes. The bronze figure declined in prominence during the Middle Ages, but became exceedingly popular again during the 15th century in Italy. Princes, scholars and the educated classes commissioned them, purchased them and displayed them proudly.

The revival of the bronze statuette was more than fad or fashion. It was closely tied to the rise of humanism and the attempt to re-establish the values of the classical world. Although the Renaissance did not cease to be God-centred, the focus now was on the individual and the sense of human dignity and worth. Many Renaissance beliefs had roots in Christian philosophy and theology of the Middle Ages which insisted that man was capable of finding God through his senses. In the Renaissance the belief in salvation through Christ presented a new opportunity for fulfilment and emphasis was placed on the development of innate, God-given qualities.

Humanism looked to the classical world, for it seemed that ancient Greece and Rome represented a high-water mark in man's intellectual, philosophical, political and artistic development. It was believed that the Middle Ages had been divorced

"The Wrestlers" attributed to Giovanni Francesco Susini.

from the classical world and a bridge was now sought, not to make time stand still or to preserve a past tradition, but to continue and surpass it. This was a considerable goal, for the achievements of the ancients were thought to represent perfection, and to surpass them was indeed a high ambition.

The humanists were actively involved in studying classical authors and ancient manuscripts which had references to small, highly-prized bronzes. In emulation of the ancients, they began collecting bronzes. Perhaps the collectors were displaying knowledge gained from research, but they were also attempting to extend the classical tradition. Here was another way to develop the faculties of man—genius could be revealed in an intimate, personal way. Unlike the large sculptures of the town square, the small bronzes could be contemplated privately at home.

An important centre for the development of the statuette was the university in Padua, one

"Hercules and the Cretan Bull"
attributed to Giovanni da Bologna

French ormolu clock, Louis XVI period

Bronze satyr produced by a follower of Riccio

of the foremost seats of humanist activity in Italy. It attracted the sculptor, Donatello, who arrived in 1443 and stayed about 10 years while he worked on two major projects. One was the altar for the Santo executed in bronze and the second was the Gattamelata monument, a large equestrian statue for a public square. The monument clearly owes something to the Marcus Aurelius monument in Rome and may be seen as a Renaissance attempt to match the achievement of ancient Rome. Donatello's work is not slavishly classical, however, and the male figure astride his horse is dressed in Milanese armour of the day.

Donatello raised bronze sculpture to an impressive height, creating works of such excellence that they rivalled those in stone. Although no statuettes are attributed to Donatello himself, it was through his workshop that the skills necessary for the production of the small bronzes became known to a future generation of artists. Donatello's own art is difficult to categorize. He was an individualist, whose work was highly charged with emotion reminiscent of late Gothic sculpture of Northern Europe. At the same time he cannot be described as mainly Gothic. Paradoxically, it is his individualism, rather than the details of anything he produced which is most indicative of his true relationship to the Italian Renaissance.

Many of Donatello's followers worked in a style which has been called "post-Donatellesque realism." It was, perhaps, not so much naturalistic as dramatic. An example of the style which was followed in Padua in the last quarter of the Quattrocento may be seen in a small bronze figure of St. Jerome, formerly part of an ink well (below). Less than six inches high, the figure displays expressive monumentality usually associated with considerably larger works. The straining muscles, the dynamic thrust of the body, the gaping mouth, are aspects found not only in works by Paduan sculptors, but also in paintings by such artists as Mantegna.

One of the major exponents of the bronze statuette was a Paduan named Andrea Briosco, called Riccio. His masterpiece, the Paschal Candlestick finished in 1516 for the Santo in

Two views of the six-inch figure of St. Jerome. Paduan, 15th century

Padua, was a prototype imitated and adapted by numerous followers, especially in those Cinquecento bronzes which depicted satyrs. These lustful, bestial creatures were not illustrated in a pure form in the Middle Ages. Their discovery seems to be linked to the existence of fragments of classical sculpture which would certainly be known and collected in the humanist circles frequented by Riccio.

One example clearly influenced by the design of the Paschal Candlestick is in the ROM's Lee Collection (p. 8). It is similar to a bronze formerly in the Barsanti Collection, now in the Palazzo Venezia in Rome.

When Riccio died in 1532, Italian sculpture had already been influenced for many years by the titanic genius of Michelangelo. The latter's death in 1564 left a void in the development of Florentine sculpture which was filled eventually by Giovanni da Bologna, a Fleming who came to Florence in 1544. He began in the service of the Medici who commissioned him to execute not only large works in marble but also small bronzes for diplomatic gifts.

His first major work was the Fountain of Neptune at Bologna which he began about 1563. About the same time he completed a small bronze figure of Mercury which was later developed into the famous Mercury sent to Emperor Maximilian II of Austria. Bologna's style reflects the influence of Michelangelo, both in his large marble works and in the numerous small bronzes for which he is best known. Between 1576 and 1581 he worked on a set of silver statuettes, now lost, depicting the Twelve Labours of Hercules. The figures were also cast in bronze, and became so popular that they were copied and adapted down to the 19th century. A version of the piece portraying Hercules and the Cretan bull is displayed in the ROM's European Galleries (p. 6).

The High Renaissance style spread to Venice propelled by the Sack of Rome. Although Italy had felt the humiliation of foreign invasion for several decades, the army of Emperor Charles V of Spain mutinied and the Spanish troops invaded Rome and sacked the city in 1527. Not since the barbarian invasions had there been such violence and destruction in the eternal city.

Mars or Perseus of Aspetti

In the ensuing chaos, many prominent artists fled to safer regions. Among them was Jacopo Sansovino, an architect and sculptor who settled in Venice. His style, influenced by Michelangelo and incorporating elements of Mannerism, was dominant in Venice until the end of the 16th century. It was transmitted through Alessandro Vittoria and reached its ultimate development in the generation of sculptors led by Tiziano Aspetti.

Aspetti, who died in 1607, executed many small bronzes. One favourite figure of his workshop was Mars or Perseus. Several examples survive, the finest being in the Frick Collection in New York. The ROM's example (p. 10) compares with a version in Vienna. Here one sees the elongated proportions and spiral twist —the so-called *figura serpentinata*—characteristic of Mannerist art. This statuette in all probability was later than Aspetti's reliefs of 1592 for the Cathedral in Padua, although they are similar stylistically.

By the 17th century the golden age of the Renaissance bronze statuette was passing. The Baroque era brought with it new attitudes toward sculpture which could not accommodate the small bronze as it had been known to the humanists. The emphasis on drama brought about a re-introduction of size as a factor in the arts. Also, the unification of the state created an emphasis on gigantic projects to glorify the ruler. The effect could be achieved by a large single commission or by cumulative works. There was a return to the grandiose scale for public purposes. Perhaps it was a sort of "big brother" approach summed up in the statement attributed to Louis XIV, "L'état, c'est moi."

By this time too, it had become possible to mass produce bronzes. As the process became

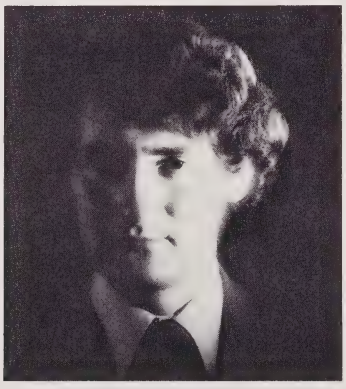
Detail of 18th century French ormolu candelabrum

more and more industrialized, the controlling hand of the artist was increasingly removed, causing a general decline in quality. Ironically, Giovanni da Bologna, one of the greatest exponents and creators of the small bronze figure, was a major contributor to the techniques of its mass production and its subsequent decline. To ensure supply for the great demand, Bologna made clay and wax models for his bronze sculptures but often did little more. The models were handed to assistants who did the casting and finishing. We do not know much about the methods, nor are they especially important. The significant feature is the division of labour whereby different individuals were entrusted with different stages of production. Casting methods, still using the lost wax process, had been developed which resulted in an almost perfect cast. It was no longer necessary to refine all the details with chisels and files. The finished product, except in a few cases, was not the work of one sculptor and only those bronzes which are proven to be the work of Bologna can be attributed to him.

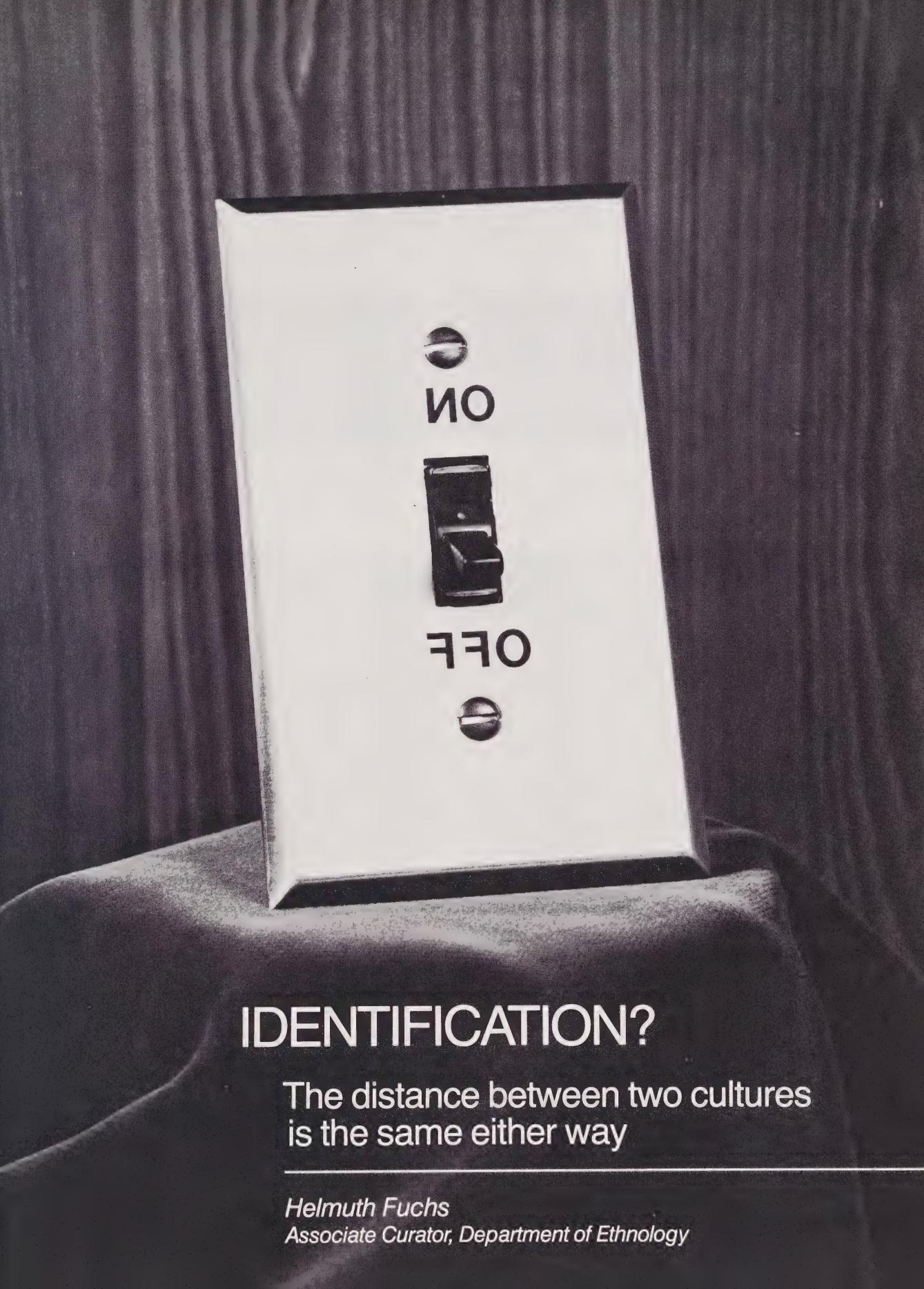
In the 17th century, bronzes of high quality were still to be found, particularly in the workshop of the Susini who had carried on Bologna's tradition. Attributed to Giovanni Francesco Susini is a splendid bronze group, "The Wrestlers," which is an early 17th century reduction of the classical marble group discovered in Rome in 1583.

The decline which began by the 17th century increased in the 18th century to become the era of the "furniture bronze." In moving toward the Rococo period where decorative schemes demanded colour and light, one finds that bronzes were gilded and the statuette became wedded to objects such as candlesticks, clocks and firedogs. Objects such as these may be seen in the Louis XV room of the ROM; the ormolu clocks and candlesticks (pp. 7 and 11) show that the statuette was relegated to a subordinate role.

The rage for porcelain in the 18th century brought about a resurgence of interest in small sculpture, and in the 19th century the small bronze enjoyed a revival, particularly at the hands of the French animaliers like Baryé who used the lost wax process to create highly individual bronzes. These, however, should in no way be confused with the majority of 19th century bronzes which were mass produced industrially. These methods destroyed all qualities inherent in the true Renaissance bronze. Many 19th century bronzes were mass produced by the same methods used to turn out everything from matches to farm machinery. These pieces bear no closer relationship to the art of sculpture than modern colour reproductions bear to the art of painting. The Medici would have rolled in their graves. So too would poor Giovanni da Bologna who quite unwittingly helped prepare the way for the destruction of the bronze as sculpture and hurl it into the realm of wholesale hardware and dime-store novelty.



K. Corey Keeble, the 25-year-old Curatorial Assistant in the European Department joined the Museum in 1969. Originally from Winnipeg, he did his undergraduate work at United College, now the University of Winnipeg. He studied for two years at the Courtauld Institute of Art of the University of London in a new experimental course on the history of dress as a means of dating and attributing works of art. Because of the success of the course it is being continued. Mr. Keeble is also interested in theatre and is currently active in the Genesians, a group devoted exclusively to Christian drama.



IDENTIFICATION?

The distance between two cultures is the same either way

Helmuth Fuchs
Associate Curator, Department of Ethnology

Problematic bone object excavated by Wagner (courtesy E. Wagner)

During my last journey to Rugandia, I visited what has become the world's most important Museum of Western Cultures. In the gallery dealing with "Material Culture" a small case exhibited a whitish, rectangular plate, approximately two by three inches, with a centre opening into which a small stick-like lever was inserted. The label on the case read:

Analysis of material: negative; neither wood, bone, stone, resin, nor any other known material.

Description: Centre lever movable in an angle of about 90° about an axis located immediately beneath the smooth surface of the plate. On one side of the rectangular opening, three still undeciphered codes indicate FFO; on the opposite side other codes, similar in character but one digit shorter, indicate ON.

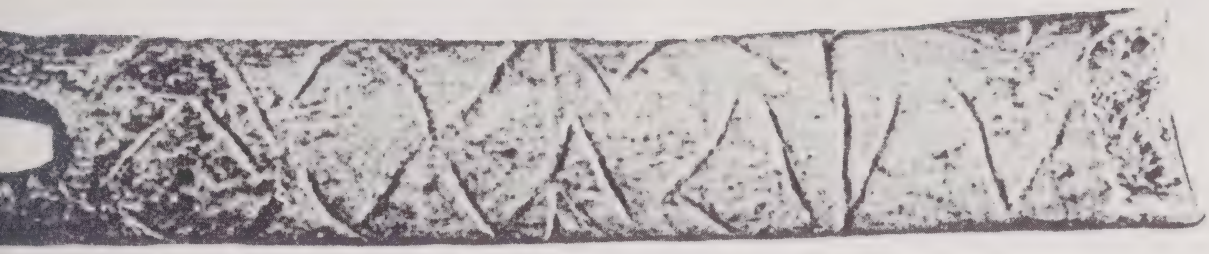
Identification: Although the exact meaning of these hieroglyphs is unknown, our expedition positively identified the item as one used among the Westerners to produce light and, ambivalently, darkness. Experiments in our laboratories could not confirm the effects claimed by the expedition. Hence we conclude that the proper use of the specimen exerts some magic or hallucinatory power among the Westerners. The two abovementioned hieroglyphs seem to constitute the key to a better comprehension of the psychological mechanisms underlying not only the phenomenon as such but also the entire Western cultures, in which ambivalences and antitheses seem to be of utmost relevance to individuals and to society.

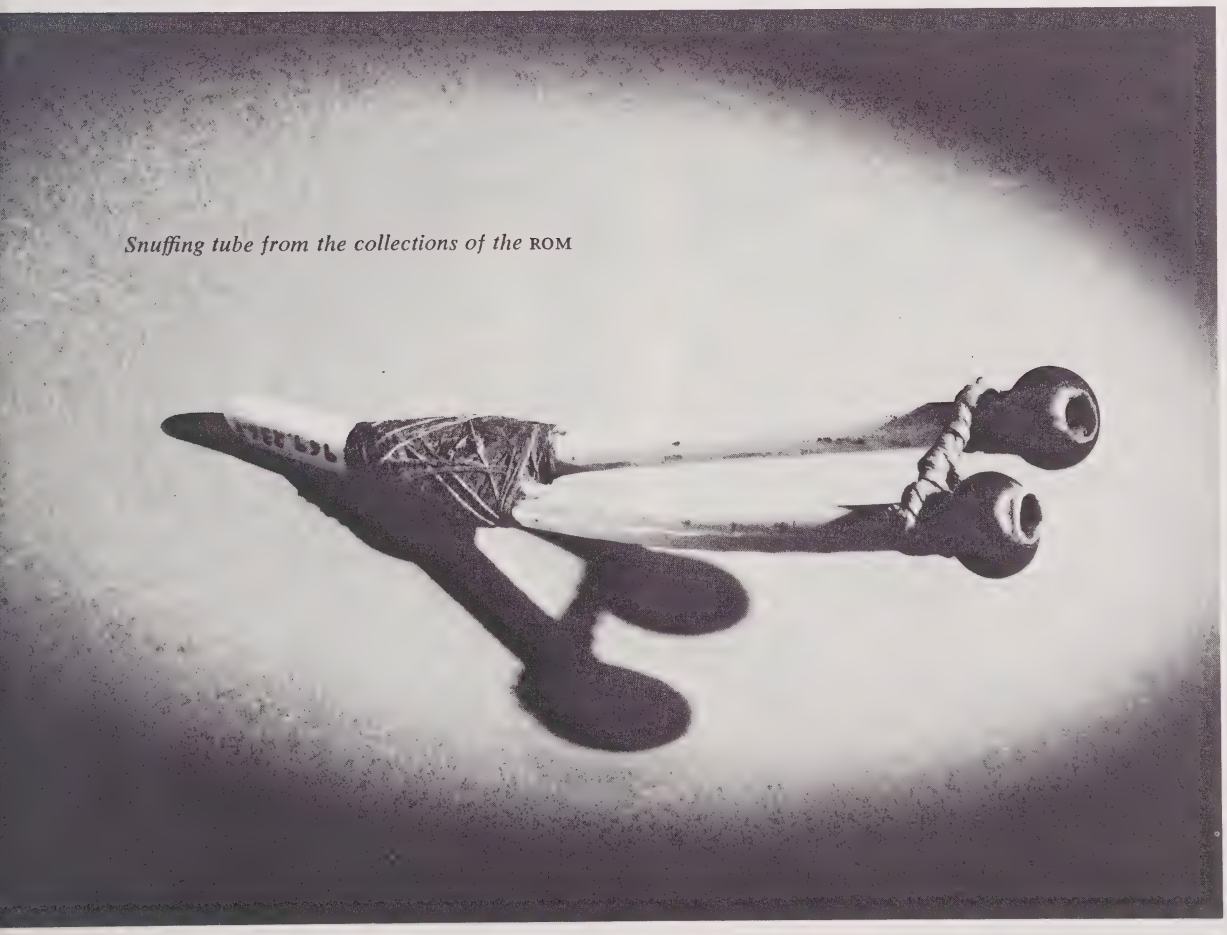
Fortunately, a photograph of the specimen, almost lifesize, was available at the Museum's sales desk. Permission to reproduce it here was generously granted by the competent authorities.

Our fable of the Rugandian light switch illustrates that the proper identification of a cultural object depends very much on the general knowledge of the culture from which it has been extracted. Likewise, the explanation of this object to the public must be in accordance with our own cultural backgrounds. In short, the distance between two cultures is the same *either way*.

One of the most tedious tasks in Museum work is the proper identification of specimens. After all, a Museum is not a junkyard of half-known or unknown objects of natural or cultural provenance. Time and work is invested in studying each of the items it houses, thus serving as a source of documentation and information to the community by which the Museum is maintained. Making an object speak, telling its history and meaning, and placing it within the framework of scientific purpose, is involved in the process of identification.

It would be a mistake to assume that identify-





Snuffing tube from the collections of the ROM

ing specimens is always an exciting job. Hundreds of items are processed routinely without further incident. Only rarely is a specimen new to science discovered, and, fortunately, also rarely is an error or even a fraudulent specimen revealed.

Adequate translation of information requires thorough knowledge. Yet, accurate and painstaking description does not always imply or lead to the correct meaning and use of a specimen. Once an artifact is extracted from its cultural context without the respective documentation, valuable information may be lost forever. The object's informative value decreases to a point where it could indeed become simple junk. Interpretation *a posteriori* results at best in more or less plausible speculation, but the degree of plausibility is rather unpredictable. Examples from my own experience will illustrate the difficulties.

In 1933 Cornelius Osgood of Yale Univer-

Funerary urn, excavated at La Pica, showing bones similar to that discovered by Osgood (Photo by the author)

Vertical diadem of feathers, the base flexibly bound by fibres

Bones from the urn, arranged as in a pectoral (Photo by Takacs)

sity, New Haven, excavating at the Tocorón site in Central Venezuela, came across an object which he described as follows:

"The specimen was found in two parts in the same unit of excavation. The fragments as they are measure a total of 12 cm in length and for the most part are 1 cm in diameter. The bone, which has not been identified, is hollow and almost round in cross-section, flaring out, trumpet-like, at one end (Fig. 15,G). Two opposing elongated slots were cut, apparently in the centre of the instrument. These slots confuse conjecture as to function, for in other respects the specimen looks like a ceremonial drinking or snuffing tube. The whole surface is filled with incised chevron and encircling lines."

Exactly 30 years later, in 1963, at the La Pica site only 20 miles from Tocorón and pertaining to the same cultural complex, I came across a funerary urn containing 64 of those bones described by Osgood. They lay in a semicircle around and partly beneath the jawbone. Although slightly longer (14 cm) than Osgood's specimen, they bore exactly the same characteristics. At the wide ends, traces of resin could be detected. The large number of tubes and their position around the neck ruled out the possibility of their being drinking or snuffing tubes. They were either part of the base of a vertical diadem, or a necklace. The bases of diadems are not only much shorter but exclusively of bamboo, never of bone, and never strengthened by resin but rather kept flexible by binding with thread. We therefore believed the bone tubes to have formed a pectoral. Similar adornments of bone and teeth are known among Venezuelan Indians today.

In this case, conjecture about an archaeological object was corrected by another archaeological object. The final interpretation, however, was possible to only a degree of plausibility, because of insufficient ethnological parallels. Since both the Torocón and La Pica sites date from just before the Conquest, better descriptions of the Indians of the area by early discoverers might have helped identify the specimen more definitely.

Our second example is a very inconspicuous item, excavated during 1963-4 by Erika Wagner

of the Venezuelan Institute for Scientific Research. It was described under "Miscellaneous Bone Artifacts" as "A spherical object with a medial crest, of which half has been truncated by a central cavity. It has been polished and is 2.5 cm in diameter. Its use is unknown. Location: El Chao. Comparison: No similar objects have been described in the literature."

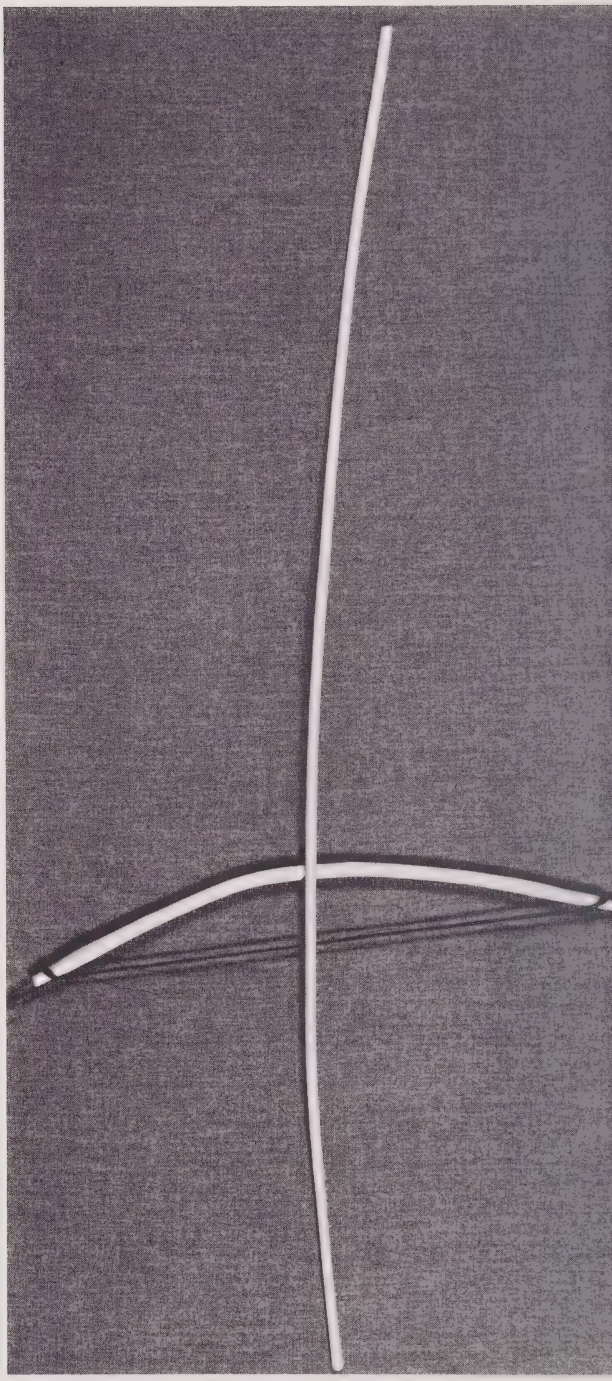
Our own ROM collection from the Guajiro Indians of Venezuela and Columbia may help illustrate the use of the object found by Dr. Wagner. Two blunt arrows, "irauwa" in Guajiro language, are described identically: "Composed arrow. Shaft made of scraped wood of Anona Muricata sp. Point of scraped Macanilla wood (Chamaedorea sp.) on the top of which is affixed a *pierced spherical piece of wood* [italics mine]. The very top is capped with a 38 SPL cartridge casing as protection. Around the joint a cotton string is wound on modity 974. Abundant traces of resin at the joint. Use: as a projectile in the hunt of birds and reptiles." The diameter of the pierced spherical piece is 30 mm.

One can hardly deny a striking visual resemblance between Dr. Wagner's item from the Venezuelan Andes (photo p. 14) and the two arrows from the Guajiro Peninsula. However, there will always be a time and plausibility gap. The ethnological parallel by no means identifies the archaeological specimen, but its use is now less an unknown than a possibility.

Again, there are occasions on which one ethnological item is identified by another ethnological specimen. Most tribes still using the bow and arrow produce a small set of these weapons, with which their small boys hunt butterflies, bugs and lizards. The child's set is of course less carefully worked than the real one, a difference comparable to that between a real car and a toy car.

Here is a specimen from our collections, apparently a toy bow and arrow. The casual visitor will plausibly and logically so identify it, without glancing at the accompanying label. But we know that it is a so-called musical bow, a far distant ancestor of modern stringed instruments.

It consists of one bow and a striking stick.



Musical bow

The bow is held with one end either against the cheek or the teeth of the half-opened mouth, or against the side of the throat, rather in the manner of playing a violin. When the sinew is struck, the sound produced is generally heard only by the player. The music of the bow is produced for the player's own pleasure, and it is astonishing how few Westerners can imagine how to play it.

The musical bow, so like a toy bow and arrow, illustrates the necessity of explanatory data when showing a specimen extracted from one specific culture to a public of different cultural orientation.

A specific object may also be viewed in different ways by bearers of different cultures. In early 1959, on an expedition to the Amazon territory of Venezuela, we encountered some Waika Indians who apparently had not yet had direct contact with western culture. Our expedition and its supplies were flown in by DC-3. We supposed that these monstrous things must horrify the Indians.

I questioned them concerning the airplanes, and what they thought these things might be. They answered flatly, "Huddumwara"—sky-boat.

They saw our people going in and out of the machine, so it was obviously a means of transport. In their culture, the only equivalent was the boat. As airplanes usually move in the sky, sky-boat was the only possible interpretation of the complicated flying mechanism. The Waika had only recently adopted boat-making from neighbouring tribes, and it seemed by no means impossible to them that other people could make boats able to float in the sky. There was absolutely nothing shocking about its appearance, noise or great size.

Would the label "huddumwara" be appropriate in a supposed Waika Museum, or would "DC-3" be more adequate?

Indians watching the great huddumwara (DC-3) (Photo by the author)

Helmuth Fuchs, Associate Curator in the Department of Ethnology, was for ten years Chief of the Department of Ethnology and Archaeology at the Museum of Natural Sciences in Caracas, Venezuela. Since he joined the ROM in 1967, he has spent some time among the Guajiro Indians of Colombia and the Cree of James Bay. Dr. Fuchs believes that if you find our specimens inadequately labelled, if we did not sufficiently consider the distance between cultures, you should advise us at once. Once aware of what is wrong in our mutual relationship, we can act to improve it.

SCUBA *diver sampling plankton*

SUBLIMNOS

Researchers go underwater at Tobermory

I have often wished I could temporarily become a fish and infiltrate the fishy society. The possibilities for research knowledge that would accompany such first-hand intimate familiarity make most marine biologists, like myself, drool.

In many ways, SCUBA (Self Contained Underwater Breathing Apparatus) diving approaches this dream. The scientist can actually enter the normally toxic environment and move in it with much the same facility as a fish.

Needless to say he rates a very poor second in physical prowess underwater to any fish equalling his size, but nonetheless he is there and functioning. He can see as well as most fish (if less wide-angled) and is able to move through a considerable depth of water. But, relatively soon, he is forced by the nature of his breathing apparatus to return to

by Dr. Alan R. Emery
Research Associate, Department of Ichthyology and Herpetology

the surface, for the amount of air he carries with him is painfully finite. Furthermore, the greater the depth he attempts to achieve the more quickly his restricted supply of air runs out. Should he try to extend the safe time-depth profile, a subtle and potentially fatal physical fact of nature acts on his body.

Air we breathe contains a great deal of nitrogen—about 80 per cent. Nitrogen dissolves in our tissues normally, but does so with increased facility in the increased pressures encountered at depths. The diver on ascending must pay the accumulated debt of time, allowing the nitrogen to come out of solution slowly, or suffer painful consequences—the dreaded "bends." In many ways, especially those concerning time and depth, the human in water is still "a fish out of water."

One way of getting around the problems of an extended depth-time profile is to extend the time element to its limit. At a given depth, after a prolonged period of time, the body becomes saturated with nitrogen and regardless of further time spent at that depth, no increased time-debt accumulates. This means actually living underwater, which requires some way of eating and sleeping at depth. Sublimnos is one type of solution to that problem—an underwater house. Diver jargon utilizes the term "underwater habitat" to describe submerged houses such as Sealab, Tektite, Conshelf, and Sublimnos. Most of these habitats have exten-

A curious crayfish on the floor of Georgian Bay

Under-ice photography

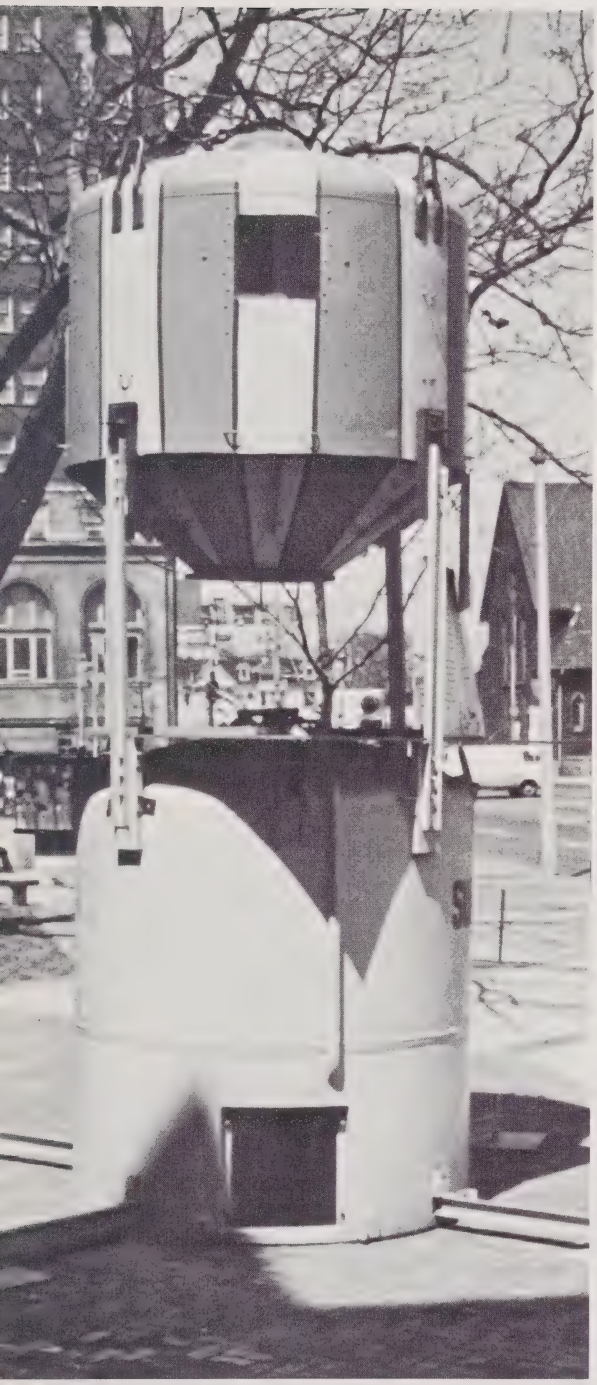
The "telephone booth"—halfway house and communications unit

sive viewing ports and the diver-scientist need not actually remain in the water to make *in situ* observations.

Dr. Joseph B. MacInnis, developer of Sublimnos, is a Canadian physician who specializes in hyperbaric physiology—studying the function of the body under pressure. At the present time he is a Research Associate of the Royal Ontario Museum. He bases his operations in Toronto, and brought Sublimnos here initially. Sublimnos was first seen in front of the Royal Ontario Museum where it was on display for over a month. From there it was moved to Tobermory, Ontario, for submersion in the cool, rock bound waters of Georgian Bay. The habitat is basically two hollow cylinders, each eight feet high and eight feet in diameter joined one on top of the other by steel girders. The lower cylinder houses the seven tons of steel ballast used to keep it down, and the upper cylinder contains the life support and scientific equipment.

One of the major objectives of Sublimnos was to prove that underwater habitation need not be a major oceanographic and multi-million dollar investment. Launching, for instance, is simple. Each separate cylinder was sealed and tipped into the water, towed to the site, and flooded for sinking. A small barge held the upper cylinder in place while divers used the girders to fasten both modules together. This done, the shore compressor was hooked up and air flooded into the upper chamber. Presto! We had an underwater habitat in which we could live. We estimate our expenses to be about one-hundredth of what other major habitation programmes have been.

Looking back now, a year and a half later, this was a very difficult time. Our compressor ran on gasoline, and often stalled; the poly-



Sublimnos *on display outside the* ROM

urethane insulating material in the habitat required about a month underwater to cure; the windows were always fogged (until we thought of using a wetting agent to clear them); and we had a constant, often annoying, string of unannounced if well-intentioned visiltors. Gradually, however, we acquired new gadgets and new ideas.

At the present time our facilities include a road to the shore and a small shack for dressing and storage of gear. This building also houses our communication equipment. Beside this little shack we have an electric, low-pressure compressor to pump air to the habitat, as well as a bank of high pressure air storage cylinders connected to a large high-pressure compressor so that our aqua-lungs may be filled at the shore line. We also have a hot water system which heats Sublimnos and, in addition, can provide heat for divers working in winter. Nearby, a generator supplies electricity.

Underwater a complex of lines carries air, hot water, and communications. It is interrupted at the 25 foot depth by a small communications unit we call a telephone booth. A plastic hemisphere traps a bubble of air into which the diver pops his head to speak to shore, to the habitat, or to another diver beside him. Further out, the habitat looms out of the green depths, surrounded by installations from long-term scientific experiments. Inside the habitat is a circular bench, several desks, lights, gas monitoring devices, temperature gauges, and a sign some jokester put up which reads in bold red lettering "Danger, polluted air."

Support for operational, developmental, and scientific endeavours has come from many sources. Prominent in the list are the National Geographic Society, the Royal Ontario Museum, the Canada Centre for Inland Waters, the Ontario Department of Lands and Forests, and the Canadian National Sportsmen's Show. Many amateur and professional divers have contributed time and effort. A very long list of organizations has contributed equipment for our operations and for diving. Scientific co-operation has been responsible for our being able to develop a comprehensive study plan. Experimenters have ranged from physicists to

physiologists, from geologist to biologist, with even a psychologist to round out the group.

We have experienced dramatic confirmation of our opinion that direct and prolonged observation underwater would yield new, even unexpected, information. At the time, I was directing a 24-hour plankton collecting station. This involved swimming in a predetermined path at regular intervals, while towing a net as close to the bottom as possible. Beautifully clear, warm water greeted us each time we left Sublimnos to collect the plankton. At 10:00 p.m. I slipped out of the hatch into the blackness of underwater night. As I dropped to the lake floor, a layer of icy water closed in on me. Quickly I turned on my flashlight. Only a dull glow resulted. Swimming back up I could see that the water in this layer was very murky. We completed the now uncomfortable sampling and retreated to the warmth of Sublimnos. I watched through the windows as the cold dirty water rose to cover the lights on our artificial reef.

As the water rose, I noticed that the behaviour of fish in the area was markedly affected. Calling for extra wet suit equipment, we began a series of observations which showed us that some species were more than just uncomfortable—they were in distress. About four hours later the intruding water receded. A rotation of assistants brought new flashlights and we completed the 2:00 a.m. sampling. On the way I noticed several dead sculpins. After the sample was completed we began a survey of several representative areas. By 4:00 a.m. I was convinced that this naturally occurring "thermal pollution" had killed many of the bottom-living and slow-moving crayfish and sculpins.

Technically the phenomenon which caused this cold water upwelling is called an internal seiche. Most deep lakes are thermally stratified —the upper layer warm, the deeper layer cold. Somewhat surprisingly the interface between them is narrow and is called the thermocline. An internal seiche is a form of underwater wave in the thermocline. It often is not detectable from the surface, although underwater waves can be of gigantic proportions. I estimated this one to be over 100 feet high.

At the present time we are, of course, pursuing an investigation of this phenomenon, but

Diver checks Sublimnos' *ballast tank*

we have also initiated a much larger programme, that of monitoring the environmental conditions as they relate to the general ecology of the bay. Hopefully this multidisciplined approach will serve as a basis for many other studies, but, as with the internal seiche, may also be unexpectedly productive.

Dr. Emery gears up for spring survey

Photographs by the author and Mrs. Emery

Dr. Alan R. Emery, a research associate of the ROM, was born in the West Indies, but came to Canada with his parents at an early age. Granted a B.Sc. at the University of Toronto, he studied for an M.Sc. at McGill University's research outpost in Barbados, West Indies. After a year with The Fisheries Research Board of Canada he studied at The Institute of Marine Sciences in Miami. In his present position with the Fisheries Section of The Department of Lands & Forests he is conducting research on some of Ontario's game fish, but retains an active interest in tropical marine biology, and participated in a research expedition to the South Pacific recently. In the same year he dove under the ice in the high Arctic and returned with many specimens to the ROM. Dr. Emery hopes that research in aquatic sciences will continue to grow in Canada, and it is partly because of this interest that he has acted as the Senior Scientist for Sublimnos.

DEMBA *camp near Ituni, Guyana*

TROPICAL BATS
Collecting in Guyana

Bats are fascinating. They are the only mammals capable of true flight. They rest upside-down. Some locate food and avoid obstacles by echolocation—a talent mechanically reproduced by man (as radar and sonar) only within the past two generations.

Most bats eat insects, but others feed on fruit, nectar, pollen, fish and—most infamous—blood. Still others eat other bats, birds, lizards, mice, beetles and presumably, in some cases, fruit.

In terms of number of species, the order Chiroptera (winged-hands) is second in the class Mammalia. Yet, despite the flood of information in recent years about bats, we remain woefully ignorant of them. Species new to science are common, and for many species only one or two specimens are known. The carnivorous bats, particularly, are poorly known.

Carollia perspicillata, *collected at Arampa, Guyana*

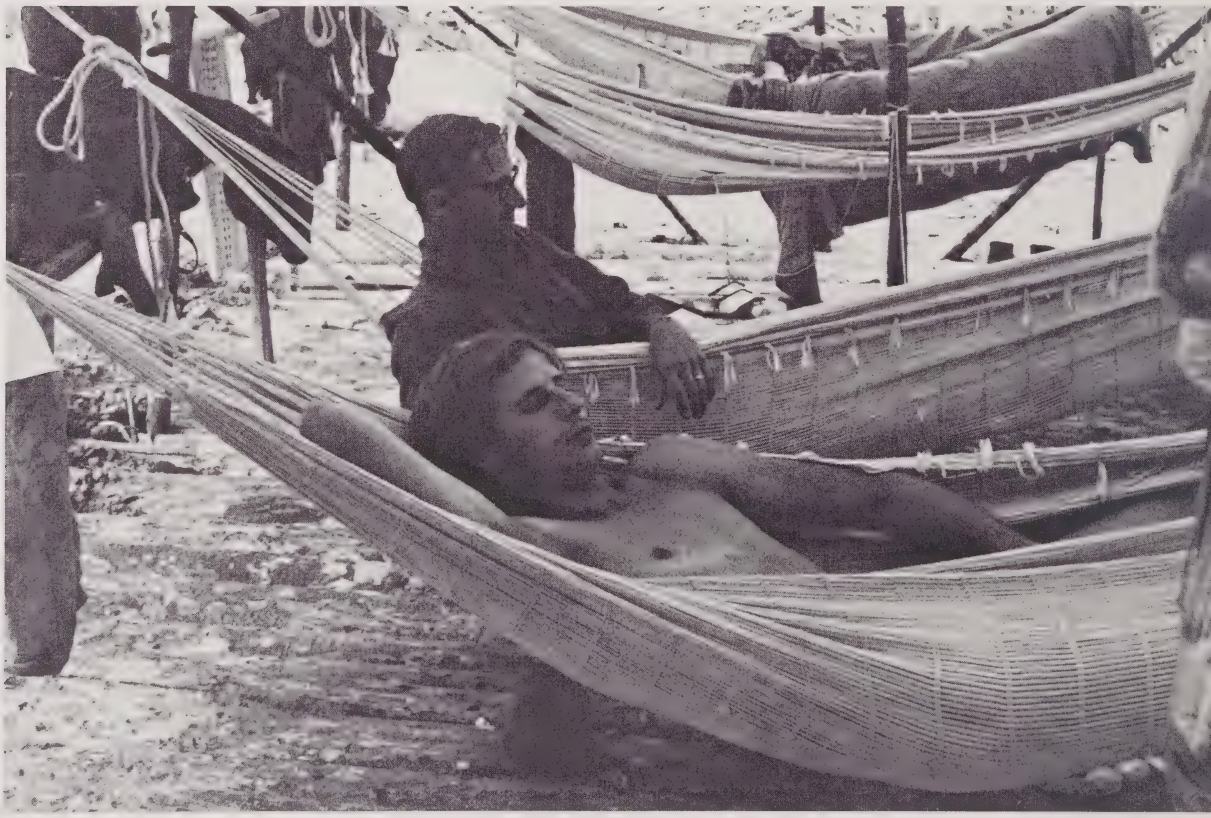
Photographs by Geoffrey Turner and the author

by M. Brock Fenton, Research Associate, Department of Mammalogy

Since bats reach their greatest diversity in the tropics, temperate dwellers are not usually aware of them. Last June, four of us went to Guyana to obtain data about tropical bats to complement work done locally. Jim Dick of the ROM's Ornithology Department, Geoff Turner, a graduate student of R.L. Peterson from Mammalogy, Ron McLaughlin, a student assistant with two years of experience in Africa, and I were prepared for three weeks of work in the back country of Guyana.

Of the four, I was the only one who had previously been in Guyana. My parents had worked there when it was British Guiana and the sole source of Allied bauxite during World War II, a connection which had put us in touch with the Demerara Bauxite Company (DEMBA). Mr. J. G. Campbell, the president of DEMBA, entrusted us to the care of Mr. Roger Sansom, DEMBA's chief geologist, and Roger had kindly arranged for us to be accommodated at a Geology Department base camp near Ituni, about 100 miles from the coast. Without the help of these people from DEMBA, not to mention others who straightened out immigration problems with the Guyanese government, our trip would have been both more expensive and less productive. Baldwin Persaud, assigned to keep us from getting lost, suffered with us through long and peculiar working hours. David Courtman, our cook, proved to be a fount of knowledge about the natural history of Guyanese wildlife, and was most helpful.

Our expedition had several aims. We were



Relaxing in camp—some more relaxed than others

interested in obtaining specimens of bats from an area in Guyana not previously studied. These specimens would aid in determining individual and geographic variation within species, and the distribution of different species. We were also interested in obtaining data concerning the amount of utilization of different habitats by bats.

Formerly, bats were collected by hand from their roosts, by skilful shooting, or as the result of chance encounters between bat and naturalist. Now the use of Japanese Mist or Fowling nets had made bats relatively easy to catch. We used mist nets set in different habitats and an ultrasonic sound detector. The habitats which we sampled with mist nets included savannah, the scrub between the savannah and the rain forest, and the rain forest itself. Within the rain forest we distinguished between the high canopy (nets set more than 40 feet above the ground), the lower bush and the creeks which ran through the jungle.

The ultrasonic detector picks up the ultrasonic echolocating cries of bats and converts them to audible signals. I had previously used this equipment to study bat activity in Ontario and, with the help of a colleague at Carleton University, Dr. S. L. Jacobson, the "bat detector" had been modified and connected to an event recorder. After this equipment was set up, it had only to be turned on about half an hour before dark and off just after

Finch trapped in mist net

dawn, and the charts from the event recorder provided a continuous record of bat activity during the night.

This method of measuring bat activity distinguishes between neither different individuals nor different species, but it does provide a quantitative measure of bat activity in a given air space (that covered by the microphone of the "bat detector"). This method alleviates the disturbance to the bats caused by the use of mist nets, but it only detects those bats which use echolocation. Moreover, those species which use low intensity pulses for echolocation are not as readily detected as the forms using high intensity pulses. This meant that the ultrasonic equipment was selected for the insectivorous bats (high intensity pulses), while the mist nets were more effective against the frugivorous forms (usually low intensity pulses).

The camp-site which was to be our headquarters had recently been chopped out of the jungle. Our beds were hammocks slung under a tarpaulin and devoid of mosquito nets. We were told that mosquitoes were scarce, and our queries about vampire bats were answered with assurances that since no one in the camp had previously been bothered, they must be absent from the area. Thus assured, we slept soundly, grateful for dark and the abatement of the sand flies. Until we got used to the hammocks, some of us slept less soundly than others.

During the first week of our stay, when we had caught no vampires, we arranged to visit the Dubulay Ranch on the Berbice River, which was reputed to be well stocked with them. We were particularly anxious to obtain some live vampires for further study in Ottawa, and to maintain them in captivity we had obtained some outdated blood from the Red Cross in Toronto. In February I had successfully brought a half-dozen vampires back from Colombia and had kept them in captivity for two weeks before they stopped eating and died. We were delighted when we started catching them within 100 yards of camp, but disappointed when we found that they did not find the out-dated blood palatable.

Vampires, of which there are three species, are the best known of the bats and immediately conjure up ideas of huge, repulsive creatures that bear their victims off into the night. In fact, they are medium-sized bats (wing span to 50 cm) with razor-sharp teeth for opening containers of blood, be they mammal or bird. Their blood-thirsty habits are harmless in themselves as little blood is involved (usually 20 grams), but they are ideal vectors for rabies and so their bite is potentially very dangerous. Throughout their range, which extends south from Mexico into South America (to Argentina), including Trinidad and Tobago alone of the West Indies, vampires are economically important because of losses to the cattle industry via rabies spread by their bites. However, programs of inoculation of cattle, while expensive, are effective and preferable to the less-effective control by wholesale slaughter of vampires.

The routine in camp was well established shortly after our arrival. At 6:00 a.m. David would appear with four cups of very hot tea and immediately after tea we set out to check the mist nets. This was both the most exciting and the worst part of the whole operation. Examination of the contents of a net was very like the excitement of mysterious Christmas packages. Since mist nets are designed to catch and hold, the unwrapping of the contents was often very trying since many of the bats seemed to be all teeth. Birds were much more difficult to remove, and the large beetles which blundered into the nets the most difficult of all. Since the beetles were promised to a colleague at Carleton, they were removed without damage and preserved, although when patience was short, some were dismembered to facilitate removal.

By the time we arrived in Guyana, we all felt like walking antibodies from the array of shots we had had. We were primed for snakes and scorpions, and so fell prey to ants. Removing anything from a mist net was trying if it involved standing either in an ant's nest or right-of-way. The ants were very jealous of both. They precipitated several frantic strip-tease performances by different members of the party.

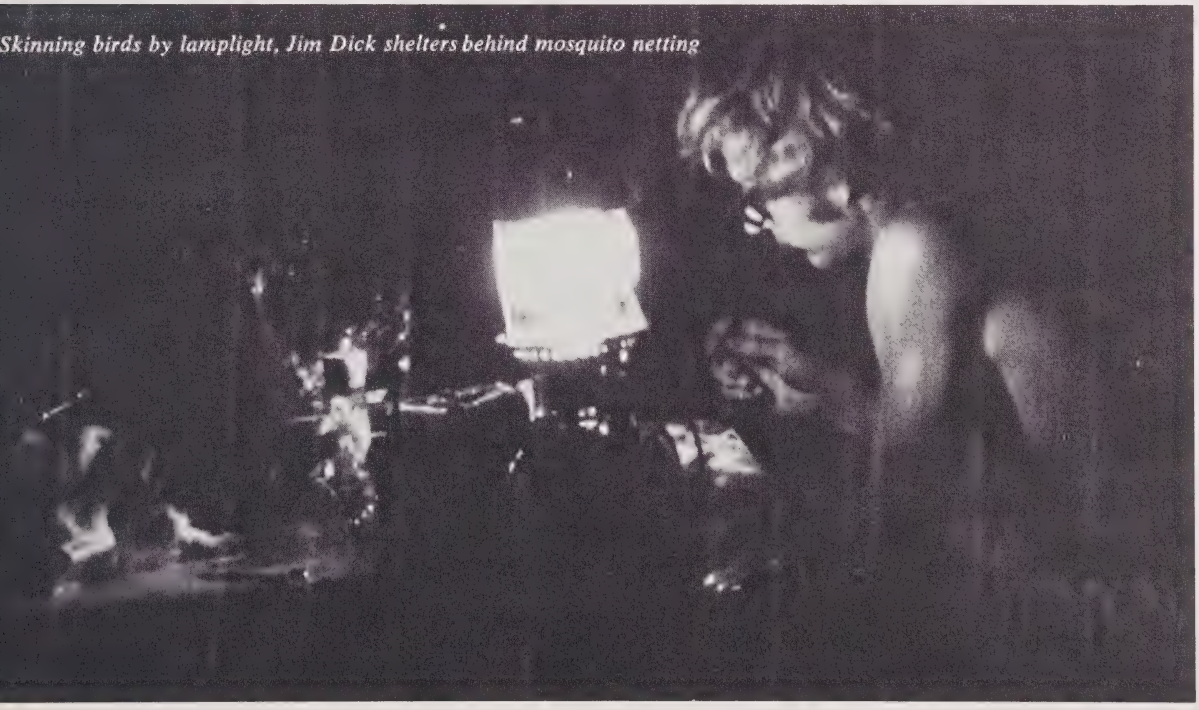
The first check of the mist nets was followed by breakfast and the preparation of the morn-

ing's catch, plus any bats that remained from the previous evening. Specimens were either skinned and the skins salted, or preserved whole in a 10% solution of formalin. After lunch the location of mist nets was altered depending upon their productivity. Usually after three nights it was necessary to move the nets because their locations had become familiar to the bats. On one occasion we were forced to move a net which a pair of savannah foxes were using as a larder—in this case we not only had to move it, but also to repair it.

For the most part, setting the mist nets was easy as there was no shortage of promising sites, and saplings to serve as poles. Nets set high in the canopy were exceptions to this. At first we set these by throwing a ball of string over a convenient limb and using the string as halyards to raise and lower the net. We soon found that David was very proficient with a sling shot and could get the string up higher and with more accuracy than we had achieved by hand.

Mist nets were checked before supper and again before going to bed. The results of this work indicated that some species of bats had definite habitat preferences. Five species were caught only in the nets set high in the canopy, four only in those set low in the jungle, and one only in those set over the small jungle creeks. Two species were encountered only along the large rivers (the Demerara and the Berbice), while three were restricted to the scrub between jungle and savannah and four to the savannah. Only two of 30 species were nearly ubiquitous; *Artibeus cinereus* was not encountered along the large rivers and *Carollia perspicillata* was absent from the nets set in the canopy.

That bats were more active in the clearing around our camp and along jungle trails than along small jungle creeks, in the thick jungle or over the savannah was obvious on examination of the charts from the event recorder. But activity in the camp clearing or along the trails was bimodal, with one peak just after



Skinning birds by lamplight, Jim Dick shelters behind mosquito netting

dark and another immediately before dawn. White lined bats (genus *Saccopteryx*, family Emballonuridae), moustache bats (genus *Chilonycteris,* family Mormoopidae) and naked-backed bats (genus *Pteronotus*, family Mormoopidae) were the insectivorous forms of the jungle trails, while several free-tailed bats (genera *Molossus, Molossops, Cynomops* and *Eumops*, family Molossidae) were their counterparts high in the canopy.

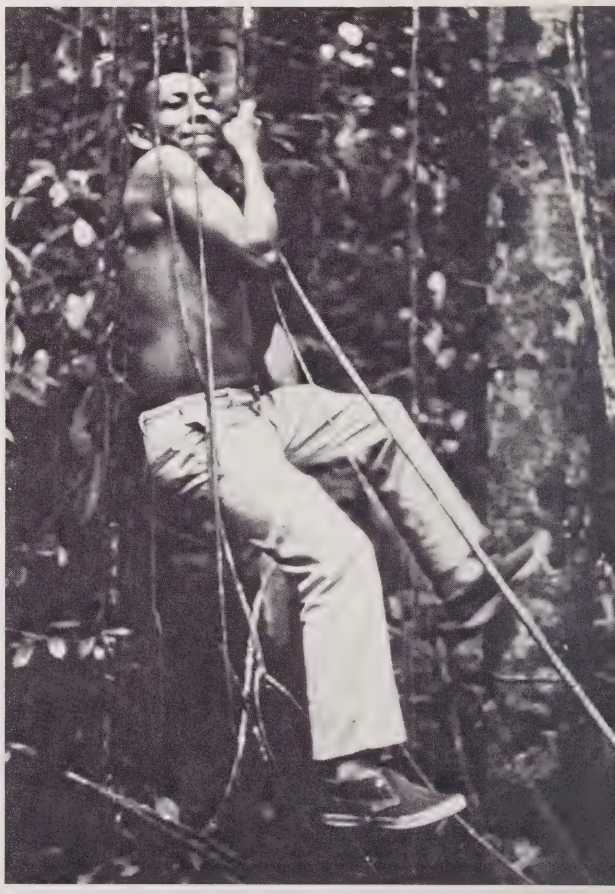
Before we knew it, it was time for Geoff and me to head over to the Dubulay Ranch, with Baldwin providing the necessary directions. The first third of the 30-mile trip covered submerged roads that passed through thick jungle, and the remainder traversed large expanses of intermediate savannah—open parklands with isolated islands of jungle. After an uneventful trip—with the exception of one rattlesnake and a flat tire—Mrs. King, the owner of the Dubulay, provided us with a welcome cup of tea and a place to sling our hammocks. When we had set our mist nets at intervals around the ranch, Mrs. King suggested that we go for a swim in the Berbice. I asked about piranha, small (15-35 cm) fish with sharp teeth and no sense of humour. She assured me that, while there were a few in the river, they *hardly ever* bit anyone. We had our swim wondering *whom* and *where*, but were not attacked.

The next morning we set off bright and early for our return trip, having removed many bats from the mist nets. We were delighted to have taken our third specimen of the rare *Ametrida centurio*, a small flat-faced bat with females so much larger than males that they had been described as different species. R. L. Peterson had, for the benefit of the species, noticed this and re-united the sexes after the ROM's first expedition to Guyana in 1961.

Work which is carried out during these brief forays into the tropics or to other distant places represents only one part of the overall picture of bat research. Expeditions to areas where the bat faunae are poorly known increase our knowledge and make it easier for further work to be carried out. Museum collections, whether the result of expeditions or the work of local collectors, come into prominence by providing basic information about the distribution of different species which is essential before ecological studies can be carried out. Identity of subject material, be it plant or animal (see *Rotunda* Fall 1969), is basic to ecological work.

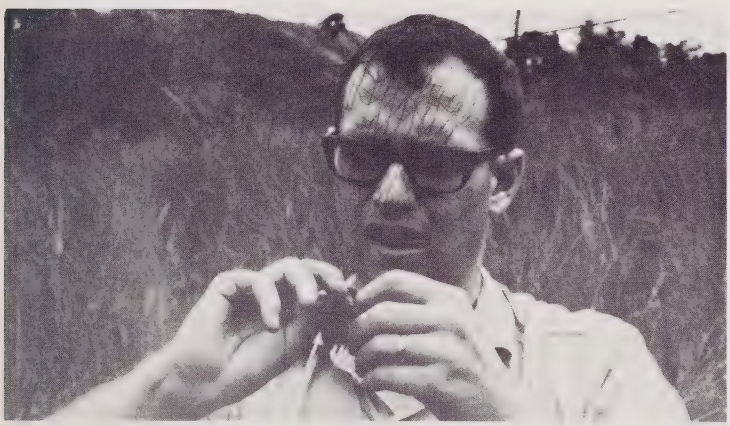
Bat research, particularly that pertaining to ecology, is not restricted to the tropics; in fact, the bat fauna of Ontario (or of Canada) more readily lends itself to some ecological studies because of the smaller fauna. With the smaller fauna, the system involving the bats is presumably less complex and therefore easier to analyze.

Another aspect of our current bat research



program has been the testing of means of eliminating bats from buildings. Last summer a Carleton University biology student, George Laidlaw, working under contract with the Canadian Wildlife Service, tested the effectiveness of light in this regard. At present it is permissible to use DDT to eliminate bats from buildings. Although DDT is effective, it involves unnecessary killing of bats, exposes householders to the poison and contributes to contamination of our environment. Since bats select attics because they are both dark and warm, either light or cold might dislodge them. George's results clearly indicated that illumination of preferred roosts and access routes reduced or totally eliminated unwanted bats as effectively as poisons, but in a cleaner, cheaper and safer way.

Insectivorous bats are major predators of nocturnal insects, but because we do not know the details of prey selection by these bats, we are unable to assess the effect of bat predation on insect populations. Within the Insecta are many examples of behavioural and morphological mechanisms which serve to protect them from visually oriented predators. If bats are important insect predators we might expect nocturnal insects to have protection against acoustically oriented predators. Recent work by K. D. Roeder has shown that nocturnal moths of several families have mechanisms for avoiding bats, having detected their ultrasonic



The author extricates a bird from a mist net

(opposite page)
David Courtman, cook and slingshot expert

Jim Dick examines a fer-de-lance

echolocating cries. In one case this avoidance behaviour has possible economic significance, since it involves the corn borer moth.

Until we are able to assess the efficiency and the role of bat predation on insects, we will not know what other benefits may be forthcoming from insect defence mechanisms against bats. Understanding the ecology of bat feeding habits and that of their insect prey may provide this information.

Of eight species which occur in southern Ontario, three appear to emigrate from the area during the winter, while five hibernate locally in caves and mines. The ability to hibernate involves complex behavioural and physiological adaptations, not the least of which is the reproductive cycle. Local bats mate in the fall but delay ovulation and fertilization until the spring by storage of sperm by the females. Some bats have gone to great lengths to exploit the insect food resources of temperate areas. It behooves us to study the predator-prey relationships related to these modifications as we may well benefit from better understanding them.

Ametrida centurio, *taken near Ituni*

"It was funny the first time somebody called me Batman," says Brock Fenton. "Maybe the first ten times." But after that—it drove him batty. Until 1969, Brock Fenton was a familiar figure at the ROM where he was working on his M.A. and Ph.D. dissertations under Dr. R. L. Peterson, Curator of Mammalogy. The subject of his Ph.D. thesis was "The Ecology of Bats with Special Reference to their Movements and Micro-Climate Selection in Southeastern Ontario," which was aided by grants from the National Research Council and the Ontario Government. Later he married ROM's attractive librarian (Eleanor Feeley) and took her to Ottawa where he is Assistant Professor of Biology at Carleton University. As Research Associate in the Mammalogy Department, he still maintains links with the ROM which has an extensive bat collection of about 27,000 specimens. Next to snakes, Dr. Fenton maintains that bats are the most maligned creatures of Canadian wildlife.

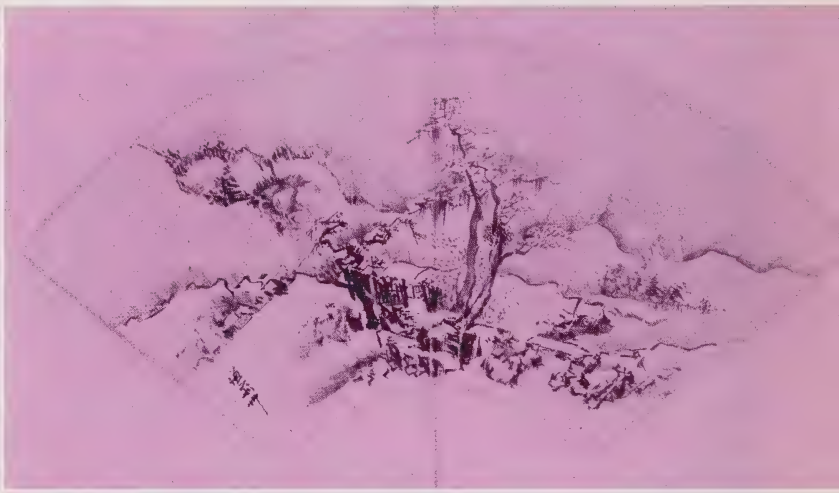
The Growing Collections

Carl Fabergé is often regarded as the greatest jeweller of modern times. In actual fact, Fabergé never made a piece of jewellery, and only expressed ideas for designs in the most general terms. He was one of the world's greatest salesmen, and this guaranteed his fame and fortune. Fabergé had at his command outstanding artist-craftsmen who had their own workshops. These filled his orders, and Fabergé sold their work through his outlets in St. Petersburg, Moscow and London.

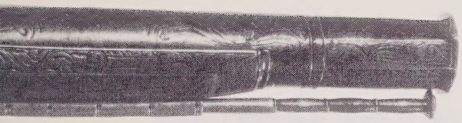
As part of a generous bequest from Helen S. and Henry W. V. Weller of Victoria, the ROM has received its first examples of work from Fabergé's famous St. Petersburg ateliers. Michael Perchin, the leading artist until 1896, made the pearl-edged silver-gilt belt buckle with clear garnet enamel over an engine-turned ground. The brooch of pink enamel on silver gilt set with cabochon sapphires and diamonds was the work of Henrik Wigström, Perchin's successor, and dates from about 1900. It was these two men who made the famous jewelled Easter eggs that were customary gifts among members of the Russian Imperial family. The riding-crop handle of shaped crystal set in enamel has no workshop mark, but is of about the same date, and also comes from a St. Petersburg workshop.

The Canadiana Department has acquired a Scottish steel flintlock belt pistol, engraved and silver inlaid, by John Murdoch of Doune, *c.* 1770-85. The pistol was the property of William McGillivray, second chief director of the North West Company, and from its markings and quality was probably a presentation piece. An oval silver escutcheon on the left side of the butt is engraved with the arms of William McGillivray. On the right escutcheon is engraved a detail from the arms: a beaver gnawing a tree and an escrol with the motto PERSEVERANCE. Underneath are the initials W McG.

Stylistically, the pistol pre-dates ownership by McGillivray. It was made with the silver escutcheons blank for later engraving. We have not yet established when or how it came to McGillivray, but are exploring the possibility of its presentation during his tenure as chief director of the NWC.



The Far Eastern Department has acquired two Korean fan paintings, by Chong San (1676-1759). Their purchase was made possible through the generosity of Mrs. George G. R. Harris and Mr. Roy Cole. Mrs. Edgar J. Stone has given three pieces of early Japanese pottery of Jomon and Yayoi types, and an 18th century Ko Imari ware cup with saucer.

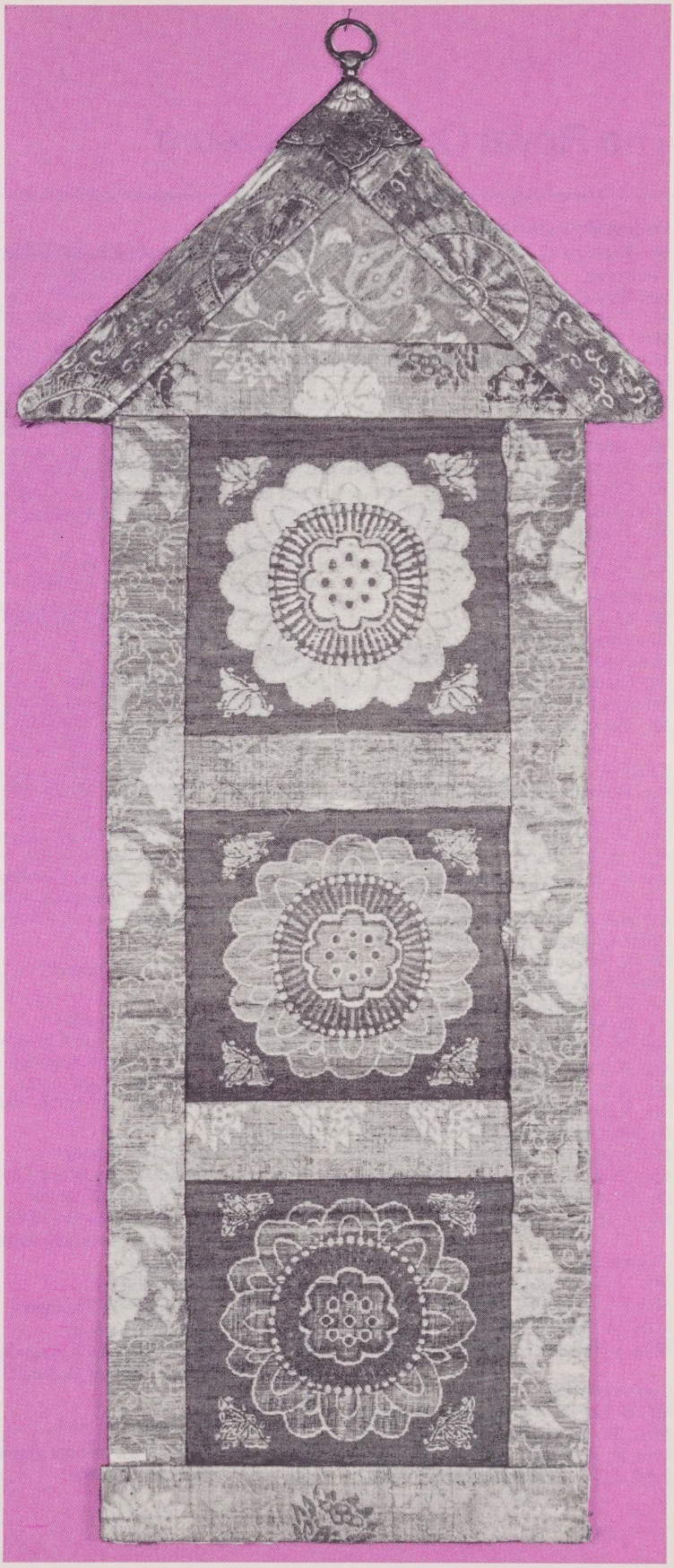


The Department of Geology, through the efforts of Dr. Walter M. Tovell, Curator, has initiated an exchange programme with the Department of Geology of the Natural History Museum in Reykjavik, Iceland, whereby some of the world's oldest rocks are exchanged for some of the world's youngest. To date the ROM has received 35 Icelandic specimens —the youngest dated May, 1970 A.D. —and has sent 14 specimens to Iceland's Museum—the oldest dated 1,100 million years.

The Museum has been most fortunate in obtaining a Japanese temple banner (*ban*) of the early Muromachi Period (1334-1567) with a gilt bronze fitting that is not later than the Kamakura Period (1185-1333). Banners of this type were ritual ornaments often hung in the courtyard of a temple on the occasion of a mass service. Originally, this one was trimmed with strips of thin silk at the corners and along the lower edge that would have fluttered in the breeze.

The panel of silk with differently coloured symbolic lotus flowers was woven specifically for the banner, and it is framed by other early silks with floral motifs. Both the back and the front are patterned in the same way so that a decorative face would always show as the banner turned in the wind.

The banner appears to be one of a set of which eight others are known. These are still in Japan, and have been registered by the Government as Important Cultural Properties.



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